MINISTRY OF SOCIAL WELFARE

JERUSALEM, ISRAEL

PREDICTION OF SUCCESS OF BLIND PEOPLE AS IBM OPERATORS

RESEARCH ON REHABILITATION OF BLIND AND VISUALLY HANDICAPPED IN OPERATING IBM PUNCH-CARD MACHINES

R E P O R T N O. 6

By

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Prepared under a grant from the Vocational Rehabilitation Administration, Department of Health, Education and Welfare, Washington D.C., U.S.A.

VRA-ISR-13-64

Jerusalem, September 1967

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in cooperation with

The Office Mechanisation Centre

The IBM World Trade Corporation (Israel Branch)

The Jewish Institute for the Blind

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Contents

F O R E W O R D

This report touches on one of the most important and most difficult aspects of the problem of training and rehabilitating the blind as a unit-record machine operator.

The good selection of trainees is generally a troublesome matter, and as we all know from our experience even with sighted operators, not always successful to the desired extent. This problem seems to be more complicated when we have before us a blind candidate for a course. It is really superfluous to underline how deeply any failure in our selection can influence the future life of a blind person.

There are many authoritative professionals in the field of ADP who still question the value of the existing tests as a clear-cut means of selecting ADP personnel and thus employ several additional techniques, e.g. interviews, short trial periods, etc. Some of these additional means are not, however, to be recommended in the case of a blind person. We have therefore to strive to find for the blind person better and more efficient objective measures for a selection.

The present study represents a great effort to get nearer to that exceedingly important area.

At this stage the picture seems to look like this:

(1) The results of the study are promising, although far from being definitive and altogether convincing. The reasons for the scientific scepticism are well elaborated in the chapter "Discussion". The recommended tests for the skills reached higher significance than those for the attitude of the blind trainee. This result is not altogether astonishing.

(2) It is worthwhile to draw attention to Appendix C, where a comparison betweel blind and normal operators is shown. For those who work in the field of rehabilitation the facts shown here are extremely encouraging. They dispell the hesitations relating to the ability of a blind operator to compete with a sighted unit-record operator. These ratings of the supervisors seem also to confirm, to a large extent, that the system and method of teaching employed in the Research Centre lead to reasonable success.

Now, what about the future phases?

1) We will try the results achieved until now in our research work, and all future groups of trainees will be tested along the lines recommended in this study.

2) We will enlarge the scope of the study and include within it also the blind computer-programmer. This is in full concurrence with the general line of our research, which now encompasses also the selection and training of a blind person to be a computer-programmer. We hope to reach also in this field no less promising results for selection tests.

3) The attitude tests used in this study are to be worked out and checked further. It is hoped to be able to raise the interest of the Central Authority for the Blind to be responsible for the continuation of the attitude test study as we feel that their results affect the blind in general and not only the blind as a unit-record operator or computer-programmer.

We hope that the modest results already obtained in this study might be of help for some researchers in similar fields. Our sincere appreciation is extended here to the Special Project Staff for their efforts and achievements in this truly difficult and complicated area.

Dov Chevion, Principal Investigator,
Director, Govt. Office Mechanisation Centre.

Introduction

Work rehabilitation of the blind is becoming of increasing importance especially in the modern welfare state. This form of assistance not only promotes the blinds' own well-being but the fairly large sums spent on training are a worthwhile investment if they help the visually handicapped to become at least partly self-sufficient and independent of social support.

Blindness has been variously defined. In Israel the working definition of a blind person is "a person unable in good lighting to move freely in an unfamiliar environment."

For free movement in an unfamiliar environment under good lighting, visual acuity must be sufficient for counting fingers at a distance of two metres or else in thers must be considerable defects in the field of vision within that range, especially in the lower and peripheral parts (Chaiott, p.7). Formally blindness is defined as follows:

> "Central visual acuity of 20/200 or less in the better eye, with correcting glasses; or central visual acuity of more than 20/200 if there is a field defect in which the peripheral field has contracted to such an extent that the widest diameter of visual field subtends an angular distance no greater than 20 degrees" (Lowenfeld, p.179).

Blindness is a physical disability preventing successful performance in most human spheres. Certain tasks cannot be fulfilled by the blind however well trained they may be, for instance tasks which call for colour distinctions. On the other hand there are many tasks which the seeing carry out almost exclusively by sight, but the blind can perform more or less equally well with the aid of other senses, such as the sense of touch. The ability of the blind to perform tasks which normal persons perform by sight is variously evaluated. There are those who think that the blind can never successfully compete with non-handicapped people in the performance of any task, all other faculties being equal. Yet there is no doubt that in tasks requiring motor coordination a dexterous blind person is likely to do better than a very clumsy normal person. On the other hand there are those who think that in tasks which do not specifically involve the sense of vision, blind people can do as well or better than **normal** people because their other senses are more highly developed **in** compensation for their failing eyesight.

Bauman and Hayes, in summing up a number of studies, reached the conclusion that the senses of blind people are no better than the norm, but "they have learned to interpret sound cues which are of no importance to those who see" (p.10) and the same applies to all the other senses. As Schweingruber,

however, points out, "the belief in physiological compensation is nevertheless widespread" (Der Glaube an die physiologische Kompensation ist aber doch weit verbreitet.") (p. 1). Probably blind people are credited with more highly developed senses because they are better able to perceive and interpret cues conveyed by these senses. The only issue relevant to our context is whether blind people are able to compete with normal people in certain tasks so that they may be vocationally rehabilitated and be no longer socially dependent.

One of the occupations often chosen for such rehabilitation is that known under the name of office machine or IBM operator. Operators are supplied with a work programme for a data processing machine from which they work out the wiring instructions for the machine (Hecht, p.2). If the blind can be successfully trained in this occupation there accordingly are good prospects of additional cadres following in their footsteps.

In Israel three courses for training blind IBM operators have been held so far. The first course started in January 1963, and a fourth course is now under way. Each course is of 10-12 months duration - several times longer than the period required for the ordinary training of IBM operators, mainly because the course given to the

blind is more intensive and also includes wiring. This appears to be the reason why the performance of the blind is rated by their supervisors to be at least as good and sometimes even better than that of their non-handicapped counterparts, especially in point of accuracy and initiative (see Appendix 1).

So far participants have been selected by the Service for the Blind of the Ministry of Welfare. For lack of appropriate criteria for this selection, youngsters who particularly distinguished themselves in their secondary studies were chosen for the first course, but in subsequent courses scholastic requirements were relaxed and also healthy elementary school graduates with a sufficient knowledge of mathematics and English were admitted. A considerable number of candidates were first given a preparatory course at the Rehabilitation Centre for the Blind, where special stress was laid on Braille, mathematics and English. To the four courses held so far 32 pupils have been admitted, 8 in each course.

Once blind people have been admitted to a training course and have passed it successfully there is generally a reasonable chance of their finding a job and performing satisfactorily in their work. Failure in the course generally also implies failure in work, while success in the course generally is a good omen for successful work

rehabilitation. On the other hand for blind people the frustration involved in failure is probably more severe than for ordinary people. Proper selection of candidates for the course therefore seems essential.

That successful completion of the course augurs well for satisfactory job performance is also borne out by the fact that the evaluation of trainees by instructors and work supervisors was practically identical. This evaluation was made as follows: the supervisors were given a list of 36 characteristics selected from Schiff & Haiman's study, and relating to different aspects of the work. They were asked to indicate six characteristics which seemed to them particularly important for a successful IBM operator. The choice was made independently by 15 supervisors. The 36 selected variables were weighted by the frequency of their choice (see Appendix A) and their number was accordingly reduced. Appendix B shows the instructors' ratings of 14 graduates of the first three courses and the 8 dropouts who either left in the middle or failed as IBM operators after finishing the course, based on the major characteristics selected. Sample ratings for less important characteristics are also presented in Appendix B. The figures show a high degree of correspondence between supervisor and instructor ratings. In every instance there was a striking difference between the ratings of trainees admitted to work and those who failed as IBM operators.

These ratings show that success in the course, as evaluated by the instructors, constitutes a satisfactory predictor of success in work. What remains to be examined are predictors for successful training.

Design

The research population consisted of 32 blind persons trained as IBM operators in one of the 4 courses at the Vocational Training Centre for the Blind in Jerusalem. It is not known whether this population is a representative sample of the blind generally or of any selected group of blind persons, but since this study was concerned with the practical problem of predicting success in the course this was not necessary. The breakdown of this population by a number of characteristics will however make it possible to compare it with other blind populations of known distribution. This is the purpose of the following tables.

Table 1 - Research population, by sex

Sex	Number	Per cent
Male	27	84
Female	5	16
Total	32	100

Table 2 - Research population, by age

Age	Number	Per cent
17-20	3	9
21-25	18	57
26-30	7	22
31-35	3	9
36-40	-	-
41-45	1	3
Total	32	100

Table 3 - Research population, by country of origin

	Number	Per cent
Western Europe and USA	-	-
Eastern Europe	3	9
Africa and Asia	20	63
Israel	9*	28
Total	32	100

*Including four Arabs

Table 4 - Trainees by year of immigration

Year of immigration	Number	Per cent
1935-1939	1	3
1940-1944	1	3
1945-1947	-	-
1948-1950	9	28
1951-1956	7	22
1957-1960	3	9
1961-	2	7
Born in Israel	9*	28
Total	32	100

*Including 4 Arabs

Table 5 - Research population, by education

	Number	Per cent
Elementary	7	22
Elementary + 1 year	-	-
Elementary + 2 years	5	16
Elementary + 3 years	7	22
Secondary	8	25
Vocational	4*	12
Higher studies (1 year)	1	3
Total	32	100

*1 also attended 3 years of secondary school.

Table 6 - Research population, by family status

	During the Investigation		During the Course	
	Number	Per cent	Number	Per cent
Bachelor/spinster	23	72	28	88
Married	8	25	3	9
Divorced	1	3	1	3
Widow/er	-	-	-	-
Total	32	100	32	100

Table 7 - Research population, by degree of blindness

	Number	Per cent
Absolutely blind	14	43
Partially blind	18	57
Total	32	100

Table 8 - Research population, by onset* and degree of blindness

	Totally Blind	Partially Blind	Total	Per cent
From birth	1	6	7	22
Before the age of 4;0	6	4	10	31
After the age of 4;0	7	8	15	47
Total	14	18	32	100

*In case of progressive blindness - onset of visual defect.

Since the trainees attended four different courses there is some difficulty in comparing the ratings of graduates of one course with those of another course, particularly since they were made retroactively from the instructors' memory and not right after each course. To overcome this drawback each course was considered as a separate unit. It was assumed that at least the internal ranking of the trainees within the course would be valid even if the courses could not be compared with one another. Comparison between success in the tests and in the courses was accordingly made by Spearman rank order correlations so that each course constituted a quasi-replication of the other courses. For the fourth course which is still under way the ratings were made according to the trainees' present standing, 9 months after the beginning of the course (see Discussion for instructors' ratings as a criterion).

In view of the small number of trainees in each

course it was impossible to distinguish between absolutely and partially blind trainees in each course since this would have led to a further subdivision of the small groups of 8. When dealing separately with the absolutely and partially blind the distinction between different courses was abandoned. Though this involved a certain amount of error there was no other alternative. Since the number of the congenitally blind was minimal they were not treated as a separate category.

Method

A number of variables was selected which according to the trainees' personal files might have accounted for their leaving the course or not taking up a job as IBM operators. For the absolutely blind these variables were dependence, technophobia, low frustration threshold and need for achievement. For the partially blind, who constituted a considerable proportion of the trainees two further variables were added: acceptance of blindness and readiness to use a single tactile work technique. Questions were drawn up on the principles of psychological projection (Questionnaire A). For the partially blind an additional questionnaire containing direct questions was drawn up (Questionnaire B). Questions 1 and 8 in Questionnaire A were designed to reveal technophobia; questions 2, 6 and 9 were designed to test dependence; questions 4, 7 and 11 were designed to indicate

the frustration threshold and the need for achievement. Questions 3 and 10 were intended to show non-acceptance of blindness, and questions 5 and 12, to reveal the trainees' attitude to using one instead of several work techniques.

The replies were scored as follows : Trainees first answered with "yes" or "no". According to the theory of projection the reply was interpreted as evidence of their emotional attitude. The trainee then had three statements read out to him, the first two being single reasons which might account for his reaction, and the third two reasons combined. It was assumed that when a single reason was preferred the trainee felt more strongly about the matter than when he gave two reasons together. Trainees were also allowed to state any additional or alternative reasons which were scored according to their contents.

To ascertain a possible relationship with these personality variables the Instructors were requested to rate trainees according to the characteristics suggested by Heyman and Schiff (Questionnaire 1). Work supervisors were similarly asked to rate the graduates under their charge (Questionnaire 2). Each variable was scored good, medium and poor. Graduates working as IBM operators were further interviewed with the aid of Questionnaire 3 by means of which diverse data were collected which might shed light on a possible relationship between the personality

variables, Schiff & Haiman's characteristics (Questionnaires 2 and 3) and their success in actual work. Dropouts - graduates not working as IBM operators or trainees who interrupted their studies - were asked to fill in Questionnaire 4. Excerpts from these questionnaires are attached to Appendix D. All questionnaires were filled in by an interviewer who also acted as the social worker of the course.

In addition the trainees passed a battery of 12 tests and questionnaires, in the following order:

1. Information questionnaire: a short questionnaire designed to obtain various data and establish preliminary rapport with the trainees. The questions related to knowledge of Braille, the course of the trainees' blindness, and their views about their training as IBM operators.

2. Problem Solving: designed to test the mathematical skill of the trainees. It includes 25 arithmetic problems equivalent to those of Burt which were read out 2-5 times. A number of follow-up studies has shown this test to have a high predictive value for normal people.

3. English: to test the subjects' English vocabulary with the aid of 30 multiple choice items. The course includes ordinary and "professional" English, according to the IBM manual. This test was found to measure not only the knowledge of English but scholastic achievements generally.

4. Forward Memory: The numerical memory tests of Wechsler-Bellevue, administered according to Wechsler's manual (for backward memory - see Test No. 8).

5. VISAB (Vocational Intelligence Scale for the Adult Blind): containing 43 items. The subject is required to indicate the "odd man out" of a series of four in each item. Originally the test was to be solved by the sense of touch only but the partially blind also used their eyes.

6. Questionnaire for the Blind (see Questionnaire in Appendix D): This questionnaire was specially drawn up for the purposes of this study to test the emotional readiness of the blind to succeed in vocational training. It contains 16 questions to test acceptance of blindness and willingness to compete with others on an objective basis. The questionnaire was drawn up at the Hadassah Vocational Guidance Institute by three counsellors, one of them specializing in counselling the blind. The scoring scale was established by joint discussion. Questions on which no consensus was obtained were not included.

7. Analogies: An analogy test in Hebrew containing 25 items, designed to examine abstract thinking. The trainees were asked to answer only 24. To normal people this test, whose validity has been proven in a number of studies, is administered as a closed test. In this case it was used as an open test, without alternatives. It

was thought that it would be too difficult to remember the three given words as well as the four alternatives. This seemed to be more a problem of remembering, than of effectively coping with seven words.

8. Backward memory: the second part of Wechsler-Bellevue's memory test (see No. 4).

9. Ring test: This test, invented by E.E. Arnstein, examines manual dexterity in simple manipulations. The subject is required to thread 35 rings of 8 mm diameter on a needle as quickly as possible, first with one hand and then with the other. Follow up studies have shown the test to be of medium predictive value for ordinary subjects.

10. Pins test: designed to test the ability of blind subjects to find their way about in a collection of objects and quickly manipulate them in a rather complex manner. The subject is required to insert 9 25 mm long pins and 9 6 mm long cylinders in a certain order into the 50 holes of a Purdue test table.

11. Cube construction test: a practical intelligence test specially adapted for the blind. Subjects are required to construct various patterns from a number of blocks. This test also measures spatial conception and technical comprehension.

12. Arithmetical exercises: to test the subjects' ability to do arithmetical exercises for most of which there is an

easier alternative method. The original test of 24 was cut down to 20. Ordinarily this test is a good predictor of scholastic achievement.

In all these tests the partially blind were allowed to make use of their residual vision, in line with the teaching methods applied in the course and in operating the IBM machines.

Procedure

Contact with the subjects was maintained by the social worker for the blind attending the present course. One of the subjects died after completion of the course and was not included in the results. The subjects were asked to help in evaluating the effectiveness of the course and in finding ways for predicting successful performance. It was stressed that the results would affect only future trainees and would have no effect on their own careers. Twenty nine of the 31 trainees agreed to be tested (94 per cent). As it is not known to what extent this group represents the total population of the blind there was no point in verifying to what extent these 29 represented the total group of 32.

The tests were carried out at the Hadassah Vocational Guidance Institute (51 per cent), at the trainees' place of work (26 per cent), or at other vocational guidance

bureaus in Israel; only one test was carried out at the subject's home. All the tests were administered by the same psychologist, who has been testing hundreds of blind people over the last few years. On the average the tests took close to four hours, with one or two breaks, and in no case longer than five hours. Quick rapport was established with the subjects and as a rule there was no problem of motivation. It should be noted that the subjects' readiness to participate in the study ran parallel with their job integration. Those who were working, especially as IBM operators, showed greater motivation than those who were unemployed.

The individual ratings for achievements in mathematics, English, professional English, theory, wiring and work in the machine room (operating the machines) were separately ranked by two research workers. The Spearman correlations between the separate rankings were 0.994 in Course I, 0.964 in Course II, 0.964 in Course III and 0.756 in the current Course (Course IV). Subjects with different rankings were given an intermediate score.

Most of the questionnaire answers were scored by three, and some by two, research workers according to a predetermined scale. In case of differences of opinion an attempt was made to reach consensus by discussion. In 5-10 per cent of scores a majority decision of 2:1 had to be made. Since there was no time to examine the questionnaires

in a pilot study no data on their reliability and validity are available except those found in the present study. The validity data are presented in the following chapter.

Results

In the following table their replies are summed up according to their projective significance. A plus sign indicates the presence of the characteristic tested while a minus sign indicates its absence. A double plus sign denotes a higher intensity of the reason given and accordingly of the characteristic examined.

Table 9 - Responses of successful trainees and dropouts to Questionnaire A (Appendix D)

Dependence

Question 2	++	+	−	−−	
IBM	5	4	2	3	14
D.O.	−	3	4	1	8
Total	5	7	6	4	22

Question 6	++	+	−	−−	
IBM	3	8	−	3	14
D.O.	2	6	−	−	8
Total	5	14	−	3	22

Question 9	++	+	−	−−	
IBM	2	2	6	4	14
D.O.	5	1	−	2	8
Total	7	3	6	6	22

Frustration Threshold

Question 4

	++	+	–	––	
IBM	3	2	6	3	14
D.O.	–	2	2	4	8
Total	3	4	8	7	22

Question 7

	++	+	–	––	
IBM	2	9	1	2	14
D.O.	0	4	0	4	8
Total	2	13	1	6	22

Question 11

	++	+	–	––	
IBM	4	10	–	–	14
D.O.	3	5	–	–	8
Total	7	15	–	–	22

Technophobia

Question 1

	++	+	–	––	
IBM	2	1	10	1	14
D.O.	–	–	5	3	8
Total	2	1	15	4	22

Question 8

	++	+	–	––	
IBM	3	4	–	7	14
D.O.	–	3	2	3	8
Total	3	7	2	10	22

Acceptance of blindness

Question 3

	++	+	–	––	
IBM	1	5	1	1	8
D.O.	–	5	–	1	6
Total	1	10	1	2	14

Question

	++	+	–	––	
IBM	3	3	2	–	8
D.O.	1	4	1	–	6
Total	4	7	3	–	14

Use of single technique

Question 5

	++	+	–	––	
IBM	2	4	1	1	8
D.O.	1	2	2	1	6
Total	3	6	3	2	14

Question 12

	++	+	–	––	
IBM	1	6	1	–	8
D.O.	–	1	3	2	6
Total	1	7	4	2	14

++ high intensity
+ medium intensity
– low intensity
–– absent

In the questions on fields of dependence, frustration threshold, need for achievement and technophobia, no difference was noted between dropouts and successful IBM operators. This either indicates an internal conflict on the part of the subjects, or the inadequacy of the questions. In questions 5 and 12, however (use of a single technique) a significant difference was found between partially blind dropouts and IBM operators.

Table 10 -

Partially blind

	Dropouts	IBM operators	Total
2 positive replies*	1	6	7
1 positive reply	2	2	4
2 negative replies	3	0	3
Total	6	8	14

*i.e. accepted the use of a single technique.

Interestingly enough, as may be seen from Table 11 a clear conflict was found in most cases between the overt view expressed by the deteriorating partially blind on the use of a single tactile technique and the results of the projection tests, or between these results and their actual behaviour.

Table 11 - Comparison of behaviour, overt statements and projection tests regarding the use of a single tactile work technique by the partially blind.

	Overt approval of single technique		Overt disapproval of single technique	
	use of sight	exclusive use of touch	use of sight	exclusive use of touch
Negation of single technique in projection tests	1	2	0	0
Ambivalence regarding single technique in projection tests	1	2	1	0
Affirmation of single technique in projection tests	6	0	1	0
Total	8	4	2	0

Thus the dropouts, though overtly reacting like the IBM operators revealed greater resistance to the use of a single technique in the projection tests. This might indicate a strong conflict regarding the acceptance of their condition, although in the questions specifically designed to examine this no difference was found between dropouts and IBM operators.

As stated, two comparisons were made between test achievements and success in the course a) separately for each course, without distinction between the absolutely and the partially blind, b) for all courses together, but distinguishing between the absolutely and partially blind.

The following table presents the Spearman correlations found between the test results and the trainees' ratings in the various courses:

Table 12: Spearman correlations between tests and success in Courses I-IV

	Course I N=7	Course II N=6	Course III N=8	Course IV N=8	Estimated parameter
Problem solving III (alternative solutions)	.397	.756	.097	.253	0.35
English (No. of items)	-.429	-.147	.620	-.256	?
Forward memory (No.of items)	-.614	.105	-.578	.285	Negative
Backward memory (No. of items)	-.154	-.203	.146	.429	Close to 0
Total memory (No. of items)	-.620	-.176	-.129	.475	Negative
VISAB (No. of items)	.127	.118	.661	-.030	0.20
Analogies (No. of items)	.145	-.378	.524	.530	0.25
Rings: preferred hand (time)	-.614	-.116	-.060	.217	Negative
other hand (time)	-.500	.000	.048	.470	0
(total time)	-.429	.000	.048	.542	0
Pins (ranking)	.148	.203	.036 (N=7)	.273	0.18
Cube construction test (No. of cubes)	.414	.154	.327	-.291	0.25
Arithmetical exercises (No. of solutions)	.692	.294	.506	.207	0.40
Questionnaire:					
I Acceptance of blindness	-.614	-.606	.953	-.436	Negative
II Readiness to compete	.107	.250	-.145	-.872	Negative
III Competion	.343	.359	.732	-.190	0.35
IV Persistence in competition	-.218	.206	.358	.289	0.20
Total competitiveness	.253	.515	.614	-.169	0.30
Total questionnaire score	-.218	.456	.707	-.492	?

This table shows that some of the tests definitely cannot be used as predictors of success in the course. The results of other tests hint at some predictability. It should particularly be noted that in Problem Solving, Arithmetical Exercises and Pins (of which two are arithmetical tests) positive correlations were throughout obtained in all four courses. With the first two tests the correlations were rather high.

In the English test one high positive correlation was obtained but since the correlations in the other three courses was negative this positive correlation should be taken as a random result.

Another verbal test - Analogies - showed a negative correlation in one case and positive correlations in the remaining three instances. This test may possibly be used as a predictor since two of the positive correlations found are high and the negative correlation is close to zero.

The various memory tests yielded more negative than positive correlations (7 out of 12) so that the parameter does not seem to be positive. There also was no difference between forward and backward memory although in the backward memory test one correlation was rather high. Since this high correlation of 0.429 was, however, accompanied by two negative correlations the test does not seem suitable as a predictor. Similar results were obtained

in the manual dexterity (ring) test.

The test battery contained two special tests for the blind: the construction and the VISAB test. In both fluctuations were found in the correlations obtained. In the VISAB test one positive correlation of .661 was found, but the remaining three correlations were close to zero, one negative. In the cube construction test, while there was one correlation of0.414 there also was a correlation of -.291. Obviously these tests cannot be used as predictors of success.

Questionnaire D yielded medium results. The willingness of the blind to compete on an equal basis with normal persons showed fairly good predictability. Although none of the variables resulted in a positive correlation in all four courses, the parameters seemed positive and not too low. Surprising, on the other hand, were the fluctuations found. While for acceptance of blindness a correlation of 0.953 was obtained, implying practically the same ranking, all the other three correlations were negative, one - 0.4 and two about -0.6. This was a questionnaire not tested in a pilot study and from the results it seems worth while to continue investigations in this direction.

On the whole it may be said that the only tests which showed some signs of predictive value were Problem Solving, Arithmetical Exercises, Analogues and Pins. If these training courses are regarded as a sample of other

similar courses it seems that in no case will it be possible to regard the results as significant at a certainty of 95 percent. In all the tests and in all the courses only one significant correlation of this kind was found in the VISAB test in the third course, of which the remaining correlations, on the other hand, were .127, .118 and -.030, so that no reliance can be placed on this single positive correlation. Though in Course III high correlations were obtained for acceptance of blindness (0.95) competitiveness and the total score of questionnaire D, a negative correlation was found for each in at least one of the remaining courses. Since there were only four courses, even if a positive correlation would have been obtained in all of them, it would not be significant at 0.05 since the probability of finding a positive correlation at random in all four courses is $0.5^4 = 0.0625$.

Another way of examining the results, as stated in the Design, is to distinguish between absolutely and partially blind subjects. In view of the small number of subjects, no further sub-division by course was made.

The mean scores of absolutely blind trainees who did well in the course, of whom there were eight in number, were compared with the mean scores of the three blind trainees who failed.

A similar comparison was made between the mean scores of the partially blind who did well in the course, thirteen in number, and the five who failed. Except for the Pin test, where an ordinal scale within each course was used, the comparisons were made by a one tailed t test for the entire test battery.

A difference significant at 0.05 was found only for the tests listed in the following table.

Table 13: Tests showing significant difference between successful and unsuccessful absolutely and partially blind trainees.

VISAB*	absolutely blind
Total memory tests	partially blind
Arithmetical exercises*	absolutely blind
Total of questionnaire D*	partially blind
Variable III in questionnaire D (at 0.01)*	partially blind

*positive results were obtained also in Table 12.

The following table shows the results of the comparisons made for all tests.

Table 14 - Comparison between achievements of absolutely and partially blind successful and unsuccessful trainees.

	Absolutely blind			Partially blind		
	Successful trainees mean	Unsuccessful trainees mean	Significant Not significant	Successful trainees mean	Unsuccessful trainees mean	Significant Not significan
Problem solving	20.5	15.7	not	17.8	13.4	not
English	23.8	23.7	not	20.1	22.6	not
Forward memory	6.1	6.3	not	5.6	5.4	not
Backward memory	5.8	5.3	not	5.5	5.2	not
Total memory	11.9	11.7	not	11.1	9.4	0.05
VISAB	36.5	29.3	0.05	36.7	33.4	not
Analogies	7.5	6.0	not	7.0	4.6	not
Ring test:						
preferred hand (time)	87.1"	93.7"	not	90.3"	101.0"	not
other hand (time)	95.2"	92.6"	not	88.1"	101.1"	not
total time	186.4"	182.3"	not	178.4"	202.1"	not
Pins	ordinal scale			ordinal scale		
Cube construction test	25.2	22.7	not	25.1	25.2	not
Arithmetic exercises	17.5	12.0	0.05	16.3	13.0	not
Special questionnaire for the blind:						
I: acceptance of blindness	15.4	16.7	not	14.5	13.4	not
II: readiness to compete	16.0	15.3	not	15.5	16.0	not
III: Competitiveness	11.2	9.7	not	10.5	8.2	0.01
IV: Persistence in competitiveness	17.1	16.7	not	15.8	13.8	not
Total competitiveness II + III + IV	44.4	41.7	not	41.8	38.0	not
Total questionnaire	59.8	58.3	not	56.4	51.4	0.05

Only in seven comparisons, four in blind and three in partially blind trainees the successful trainees did worse in the tests than those who failed the course. Otherwise those who did well in the course also did better in the tests. Thus on the whole the tests are indicative of success. The probability of finding a random difference in favour of successful trainees in 14 out of 18 comparisons, as was the case with the absolutely blind, is 0.017, and in 15 out of 18 comparisons, as in the case of the partially blind - 0.005.

It remains to find out whether any of the other variables examined might not also be predictors of success. Table No. 5 (p. 11) shows the distribution of the successful trainess and dropouts by their standard of education.

Table 15 - Successful trainees and dropouts by standard of education*.

Standard of Education	Successful trainees	Dropouts	Total	Percentage of successful trainees
Elementary	4	3	7	57
Elementary + 1 year	-	-	-	
Elementary + 2 years	5	-	5	100
Elementary + 3 years	4	3	7	57
Secondary	6	2	8	75
Vocational	3	1*	4	75
Higher eduction (1 year)	1	-	1	100
Total	23	9	32	72

*Including one trainee who died and two who refused to be tested.
x Plus 3 years secondary schooling.

As was to be expected the standard of education to some extent helps to predict success in the course.

Discussion

This study suffers from a number of limitations. The first limitation relates to the research population. Since the group examined does not necessarily represent the total population of the blind it is not clear to what extent the results obtained apply to the blind generally or to certain groups of blind people. Moreover, the number of subjects was too small to be able to make a distinction between different types of blindness - degree of blindness, congenital or acquired, age, etc. This is a methodological defect most studies of this kind are heir to, since the number of blind people of the same category is usually small. An attempt was made at least partly to overcome these shortcomings by treating each course separately, as a replication of the other courses. There is some justification for not regarding the various courses as different samples of the same population: In the first course 10 of the correlations were negative, in the second 6, in the third 4 and in the fourth 8. This, however, may also be connected with the evaluation method used, which in fact is a further source of limitation. The instructors' ratings, for lack of adequate records kept during the course, were made

retroactively and might thus have been influenced by what they knew of the present status of the trainees, whether they were working or not. This reduces the validity of the high correlations found between performance in the course and in subsequent work. It should also be noted that the courses were steadily improved as teaching methods were modified and adapted and that there was some prior selection of trainees. These are additional reasons why the courses cannot be regarded as full replications of one another. No adequate information on terms of admission is available and they may well have changed from one course to another, so that not only the methods of training but also the selection of trainees might have been different. This reduces the validity of some of the findings relating to the trainees as a homogeneous group.

In the present study the subjects were most willing to be tested and interviewed, partly because they were told that the test results would have no effect on their own careers but might help future trainees. Such a high level of motivation need not necessarily prevail among future trainees where anxiety about admission and similar factors might affect test performance.

Some interest also attaches to the trainees' own views about blind people working as IBM operators. When asked "what do you think about the rehabilitation of people with visual difficulties as IBM operators," the following

picture was obtained:

Table 16 - Trainees' views on the rehabilitation project

	Absolute blindness			Partial blindness				
	Successful trainees	Unsuccessful trainees	Sub-total	Successful trainees	Unsuccessful trainees	Sub-total	Total	Per Cent
1) Favourable opinion reservations	5	1	6	11	2	13	19	65
2) Stress on problems involved	2	-	2	2	2	4	6	21
3) No opinion	1	2	3	-	1	1	4	14
Total	8	3	11	13	5	18	29	100

Those who were in favour of the project stressed the interesting nature of the work and the chances of promotion it offered. Six trainees had reservations regarding working conditions, the physical effort required, the unsuitability of the work for women and the difficulties of finding a job. Two of the trainees said the course was too long because of the stress placed on conventional equipment. As was to be expected, those who did well in the course generally also thought well of the idea.

Summary and Conclusions

The results indicate that some of the tests can be used to predict success in the training course. As stated,

this was found to be equivalent to success in actual work as IBM operators. Though the correlations between the tests and success in the course were not high and did not reach the level of significance generally required for prediction, this was largely due to the small size of the population examined. Thus a Spearman correlation of 0.32 although not significant for the small number of trainees in each course, would be significant at 0.05 for the total of trainees had they all studied in the same course. The correlation of 0.3 may, however, be the parameter in the population.

Hence no significant results are obtainable without first trying out some of these tests in actual prediction. The tests and criteria suggested for this purpose are four intelligence tests (two numerical), one verbal and one spatial), data about educational standards and an attitude questionnaire, as follows:

a) Standard of education

b) Problem solving test

c) VISAB

d) Analogies test

e) Pins test

f) Arithmetical exercises

g) Special questionnaire for the blind on acceptance of their disability and competition.

In the special questionnaire certain questions should be reformulated and the scoring scale requires improvement. The present study may be regarded as a pilot study for this questionnaire which was not tried out previously. Also for the pins test, scoring by an interval instead of the ordinal scale used in the present study should be tried out.

It seems advisable to conduct a similar study on future courses as well as in a different cultural setting, so that the conclusions may become generally applicable.

On the basis of this study it is further suggested

a) To base the selection of candidates on the variables picked out as essential by the work supervisors of blind IBM operators, insofar as these variables can be ascertained. This seems preferable to a selection based on a general personality evaluation.

b) In considering possible interruption of the course, more attention should be paid to variables mentioned as essential by the work supervisors.

The Hadassah Vocational Guidance Institute, P.O.B. 1406, Jerusalem, will be glad to furnish additional data on the test results upon request.

APPENDIX A

List of Schiff & Haiman's 36 Characteristics weighted by Supervisors' evaluation as the six most essential.

1. Accuracy	14/15
2. Ability to follow instructions	4/15
3. Ability to suffer discomfort in work	0/15
4. Initiative	7/15
5. Desire to Learn the Job	5/15
6. Work attendance	1/15
7. Ability to understand instructions	8/15
8. Leadership qualities	0/15
9. Ability to get on with supervisors	0/15
10. Use and care of equipment	2/15
11. Satisfactory personal appearance	0/15
12. Unsatisfactory clothing	0/15
13. Insufficient cleanliness	0/15
14. Desire to become permanently installed	0/15
15. Wish for promotion	2/15
16. Readiness to accept superior authority	1/15
17. Ability to meet new challenges	5/15
18. Ability to accept responsibility	3/15
19. Ability to get on with equals	0/15
20. Readiness to swallow disappointments	0/15
21. Readiness to accept criticism	2/15
22. Ability to understand and cope with theoretical matter	5/15
23. Ability to find original solutions	7/15
24. Special characteristics or habits which might affect future work prospects	0/15
25. Degree of self-confidence	3/15
26. Ability to get on with subordinates	0/15
27. Recourse to memory	2/15
28. Freedom of movement in machine room	0/15
29. Ability to function within the work space	2/15

APPENDIX A (continued)

30. Degree of dexterity and speed	4/15
31. Ability to concentrate	5/15
32. Degree of persistence	1/15
33. Degree of diligence	2/15
34. Desire to succeed	4/15
35. Self-criticism	0/15
36. Readiness to compete	0/15

APPENDIX B

Comparison of instructors' and supervisors' ratings

Accuracy (14/15)

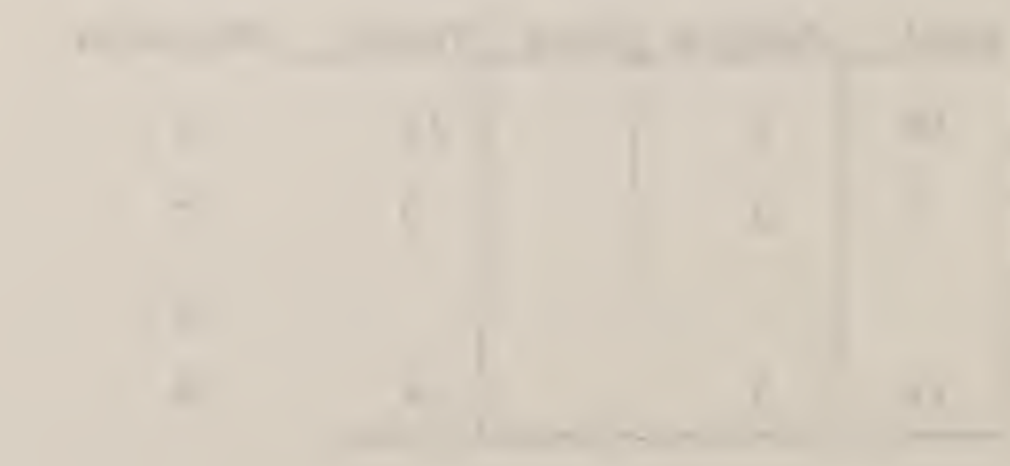
	Good	Medium	Poor	Total	Dropouts
Good	12	2		14	1
Medium					5
Poor					2
Total	12	2		14	8

Finding of Original Solutions (7/15)

	Good	Medium	Poor	Total	Dropouts
Good	9	1	1	10	0
Medium	2	1	1	4	4
Poor					8
Total	11	1	2	14	8

Understanding and coping with theoretical material (5/15)

	Good	Medium	Poor	Total	Dropouts
Good	10	1		11	1
Medium	1	2		3	5
Poor					2
Total	11	3		14	8



APPENDIX B (continued)

Concentration (5/15)

	Good	Medium	Poor	Total	Dropouts
Good	11			11	3
Medium	1	2		3	3
Poor					2
Total	12	2		14	8

Understanding Instructions (8/15)

	Good	Medium	Poor	Total	Dropouts
Good	9	1		10	2
Medium	2	1		3	2
Poor		1		1	4
Total	11	3		14	8

Initiative (7/15)

	Good	Medium	Poor	Total	Dropouts
Good	13	1		14	3
Medium					3
Poor					2
Total	13	1		14	8

APPENDIX B (continued)

Responsibility (3/15)

	Good	Medium	Poor	Total	Dropouts
Good	8	5	1	14	4
Medium					2
Poor					2
Total	8	5	1	14	8

Persistence (1/15)

	Good	Medium	Poor	Total	Dropouts
Good	9	4		13	2
Medium	1			1	4
Poor					2
Total	10	4		14	8

APPENDIX C

Comparison between blind and normal IBM operators
(Supervisors' ratings)

	Total	Same as normal	Better than normal	Worse than normal	Of 15 supervisors, mentioned by	not mentioned by
1. Accuracy	15	10	4		14	1
2. Understanding Instructions	15	4	3	1	8	7
3. Initiative	15	3	2	1	7	8
4. Finding original solutions	15	3	1	3	7	8
5. Desire to learn job	15	3	2	5	5	10
6. Ability to meet challenge	15	3	2		5	10
7. Understanding and coping with theoretical material	15	2	1	2	5	10
8. Concentration	15	2	1	1	5	10
9. Ability to follow instructions	15	2		2	4	11
10. Dexterity	15			4	4	11
11. Wish to succeed in job	15	1	3		4	11

APPENDIX D

Questionnaire A

1. A businessman I know prefers to deposit his money in the central commercial bank because there are hardly any clerks there and everything is automated. Do you think he is right?

2. A fellow from Tel Aviv prefers the university of Jerusalem even though this means that he will be away from his family during the difficult period of studies and exams. Do you think he is right?

3. A person had one of his legs cut off in an accident and now has to learn to walk again after having been immobilised for a long time. He has the choice of going straight home from the Orthopedic ward and learning to walk there, or of staying at the hospital with other invalids and receive the necessary treatment there. He decided to leave the hospital. Did he do right?

4. A high school student who had learning difficulties was told that he ought to leave school and look for some other course better fitted to his abilities and interests. The later he would do this the more failures and insults he would have to swallow. Was this advice justified?

5. A clerk in the accounts department sometimes uses the calculating machine for his additions and subtractions

and sometimes merely uses pencil and paper. He makes a lot of mistakes and it was suggested that he should decide on either of the two. Do you agree with this suggestion?

6. Somebody had to quit his job and be satisfied with partial separation pay but an appeal was lodged for full separation pay on the grounds that the man did not get sufficient guidance and instructions in his job and his supervisors did not pay enough attention to him. It was claimed that if he had received the proper guidance it wouldn't have been necessary to fire him. Do you think these claims are justified?

7. Somebody failed his driving test the tenth time and the tester of the licensing office suggested he should give up the idea. Do you think this was the proper advice to give him?

8. In a given hospital when patients are examined the results are fed into a computer which quickly comes up with the diagnosis. I have a friend who refuses to be examined in this hospital and prefers to be examined by an old-fashioned doctor and get the diagnosis from him. Do you think he is right?

9. A kibbutz member prefers to stay in the kibbutz although he actually wants to leave and work at an interesting job in town. "I prefer to stay in the kibbutz because my friends are here and I am not alone" he says, "and in town

I shall be alone though I shall be able to find a more interesting job." Do you think he is right?

10. A wounded soldier was sent to a military rest-home where there were other casualties in plaster casts who couldn't move and were sitting in wheel chairs. The soldier asked for permission to go home although his condition was no better than that of the others and although there was no medical supervision at home. Should his request be granted?

11. A new immigrant who has been in poor health since he was wounded in the second world war did not manage to find a suitable job. Since he has a family to support he was told to try his hand at a new occupation which requires a short period of training. He refused on the grounds that "I never was lucky and it is a waste of time. I am sure I won't succeed." Was he right?

12. A person sometimes gives his car to a garage for a routine checkup and sometimes does it himself. Like all cars his car sometimes stalls and upsets his plans. Do you think the way he handles his car is right?

Questionnaire B

For the Partially Blind only.

1. Should partially blind trainees be allowed to use any technique - sight and touch - or should they use a single ~~touch~~ technique, preferably by touch? For stable

non-progressive partially blind trainees, do you think

a) that it does not matter whether they go only by sense of touch

b) that it is worth while to go only by sense of touch. Why?

For partially blind trainees with a deteriorating condition, do you think

a) that it does not matter whether they go only by touch

b) it is worth while to go only by touch. Why?

2. What, to your mind, is the reason why the partially blind sometimes insist on using a non-tactile technique.

3. To your mind, is it worth while forcing the partially blind to read Braille and to go only by touch?

4. Do you think that persuasion, explanation or the experience of others should be used to get partially blind trainees to work only by touch?

Questionnaire C

For the rating of IBM operators by their work supervisors. There are three possible scores for each question: good, medium and poor. The ratings are based on the following characteristics: Accuracy; Ability to follow instructions; Ability to bear discomfort at work; Initiative; Wish to learn the job; Attendance; Ability to understand instructions;

Leadership qualities; Ability to get on with superiors; Use and care of equipment; Personal appearance; Clothing; Cleanliness; Desire to become permanently installed; Desire for promotion; Readiness to accept superior authority; Ability to meet new challenges; Acceptance of responsibility; Ability to get on with equals; Readiness to swallow disappointments; Readiness to accept criticism; Ability to understand and cope with theoretical material; Ability to find original solutions; Special characteristics or habits which might affect future work prospects; Degree of self confidence; Ability to get on with subordinates; Recourse to memory? Freedom of movement in machine room; Ability to function within work space; Degree of dexterity and speed; Concentration; Persistence; Diligence; Desire to succeed; Self-criticism; Readiness to compete; Please indicate 6 of the variables listed which seem particularly important for a successful IBM operator.

According to your experience is the blind operator better, worse or equal to normal operators in these respects.

Equal, Better, Worse, Depends on the person*

*This response is to be noted only at the supervisor's request.

Questionnaire D

1. Variable I - Acceptance of Blindness

(Persons with very defective eyesight who feel they can do things without seeing.)

a. There are people who do not see well and walk with the aid of a stick or a dog. What do you think about these aids?

b. When a person who doesn't see is in an unfamiliar environment, how does he feel and what does he do about it?

c. Are there things which a partially blind person can do just as well as a person who sees because he uses other senses more efficiently?

d. Do you think that a person who can't see can be happy?

2. Variable II - Readiness to compete (Persons with very defective eyesight who think that by using their other senses they can do at least as well as seeing persons on the same job).

e. Let us say that in your work there is a mistake which is difficult to find for people who can see. Do you feel you will be able to find it?

f. In a certain plant workers were to be evaluated for a task requiring mainly concentration and manual dexterity but not sight. The lowest score was 1 for the least efficient worker and the highest score 9 for the best worker. Seeing people averaged 5. What do you think would be the average score of those who do not see?

g. What do you think is better, that high school pupils who cannot see should attend special classes for the blind (as at the institute for the blind) or that they should attend regular classes?

h) Among other occupations blind people work as telephone operators. To your mind, can they get to the same standard of performance as people with good eyesight?

i. Do you prefer the company of people who can see well over the company of people with visual difficulties? Why?

3. Variable III - Competitiveness (Persons with very defective eyesight who when opportunity offers compete with normal people and try to attain at least the same level of achievement).

j. A plant has a temporary vacancy for which eyesight is not essential. There are two candidates, one who can and one who cannot see. What should the vocational counsellor tell the plant mananger?

k. Supposing that in the plant where you are working there is an urgent job to be done which doesn't require eyesight, and it is necessary to do overtime without pay. Do you think a person with visual difficulties should take part in this?

l. A person who can see and is just as gifted and dexterous as you performs a task in three minutes. How long do you think it will take you? (If the subject asks about training add that both have the same amount of training).

4. Variable IV - (A person with very defective eyesight who is prepared constantly to compete with normal people so as to require no outside help).

m. What would you do if as a result of changes in the transport system the bus that takes you to work is cancelled (i.e. urban bus lines)?

n. There are various reasons why people work. There are those who want an interest in life, who want to make a living, who want to get away from home - and many other no less important reasons. What was your main object in deciding to work?

o. In a training course where there are people who can see and people who have visual difficulties it is required that for lack of staff some people should make their own personal arrangements like tidying up their own rooms. Would you be one of those who would agree to look after themselves while some are looked after by others?

p. Where do you think it is better for handicapped people to work, at a "sheltered" workshop or at an "unsheltered" workshop?

APPENDIX E

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